MODIFIED CELLS AND METHODS OF USING SAME
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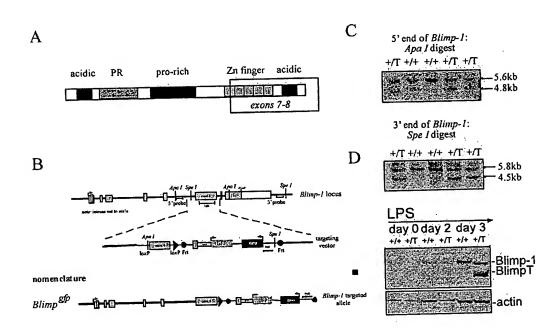
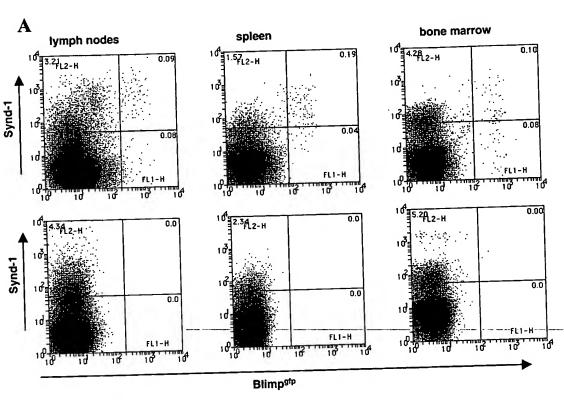


FIGURE 1

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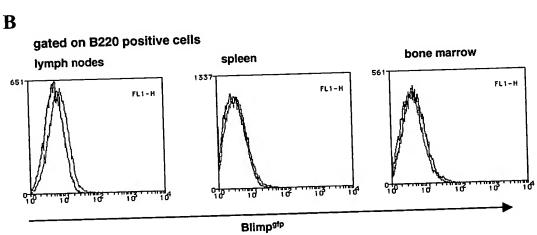
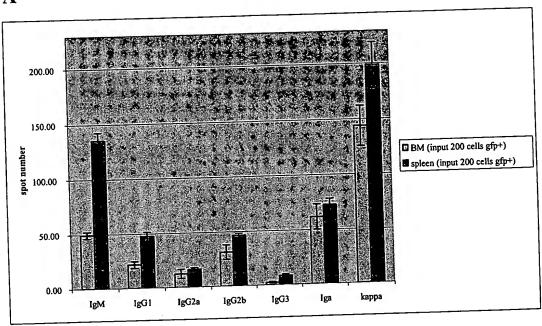


FIGURE 2

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 3 of 39

A



B

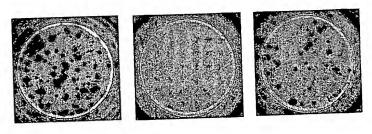


FIGURE 3

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 4 of 39

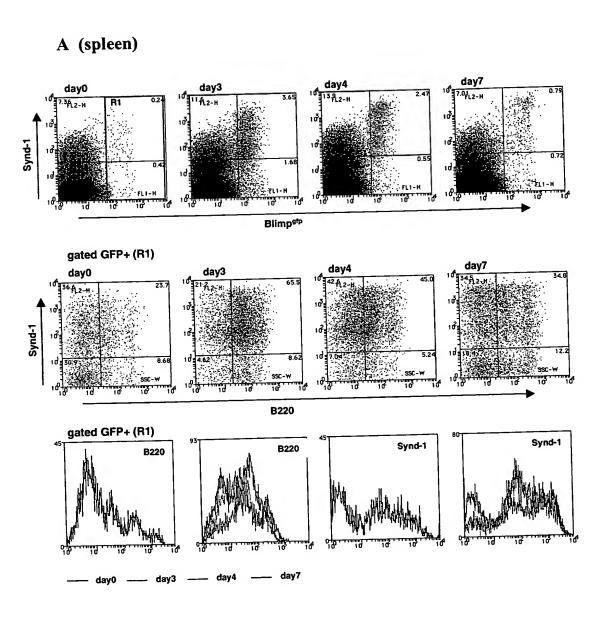


FIGURE 4

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 5 of 39

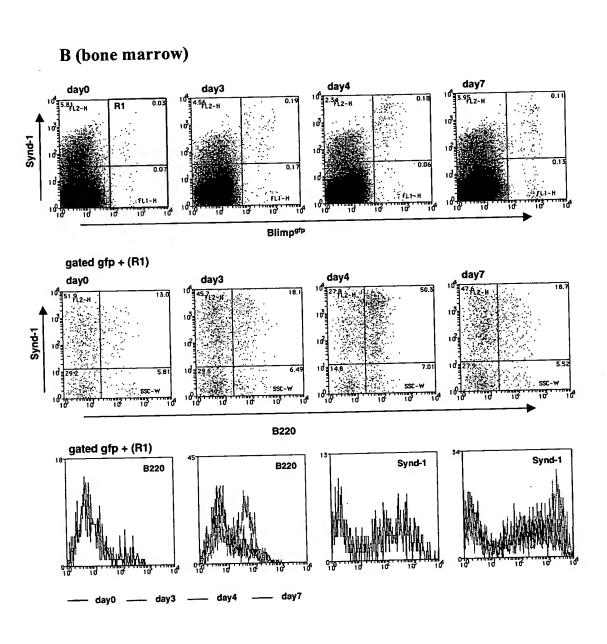
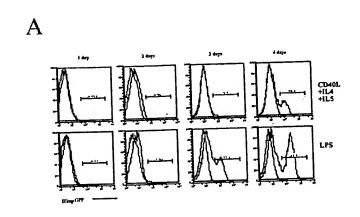


FIGURE 4 cont.

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 6 of 39



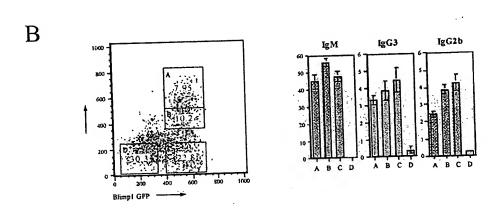




FIGURE 5

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 7 of 39

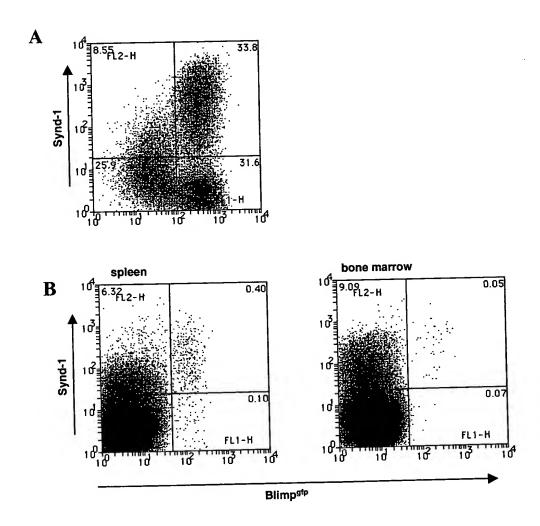


FIGURE 6

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 8 of 39

A

 $blimp^{gfp/+} x blimp^{gfp/+}$

	-			blimp ^{+/+}	blimp ^{gfp/+}	-	blim	p ^{gfp/gfp}	
•	# of mice born			19	25		_		
В	blimp ^{gfp/+}	blimp ^{gfp/+}	blimp ^{+/+}	blimp ^{gfp/+}	blimp ^{gfp/gfp}		blimp ^{+/+}	blimp ^{gfp/+}	blimp ^{+/+}
			9 - 15 - 7 - 2			į			e) (T2-23)

genotyping of born mice

genotyping of E9.5 embryos

FIGURE 7

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 9 of 39

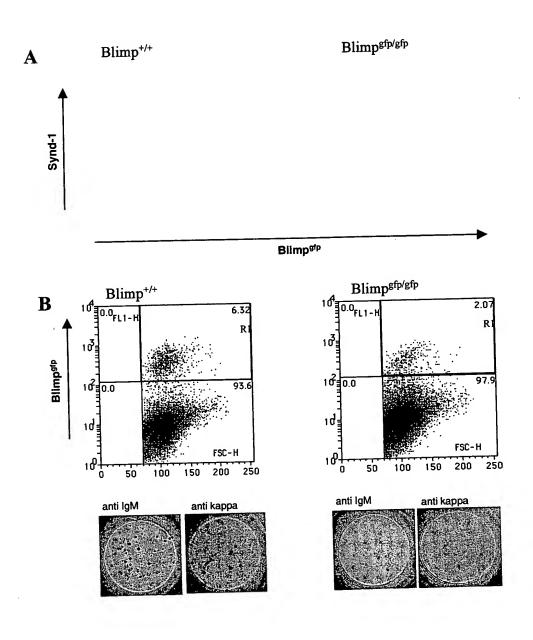


FIGURE 8

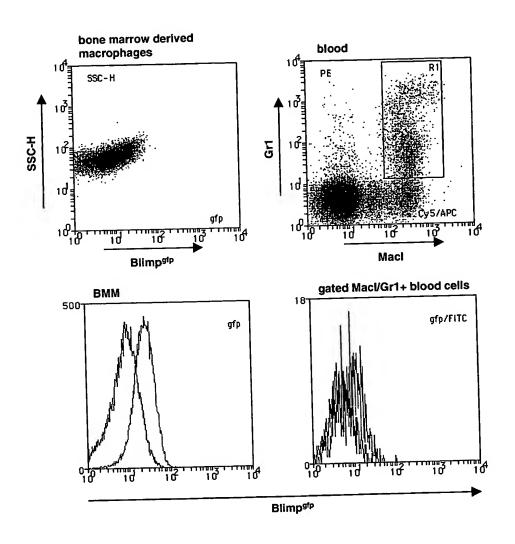


FIGURE 9

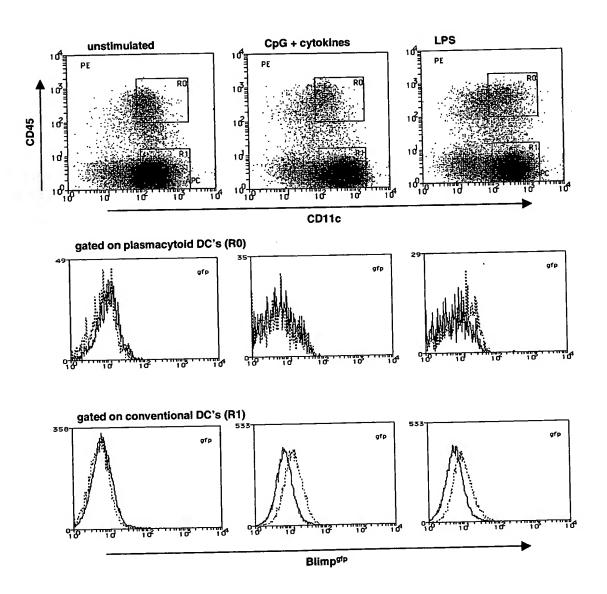


FIGURE 10

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 12 of 39

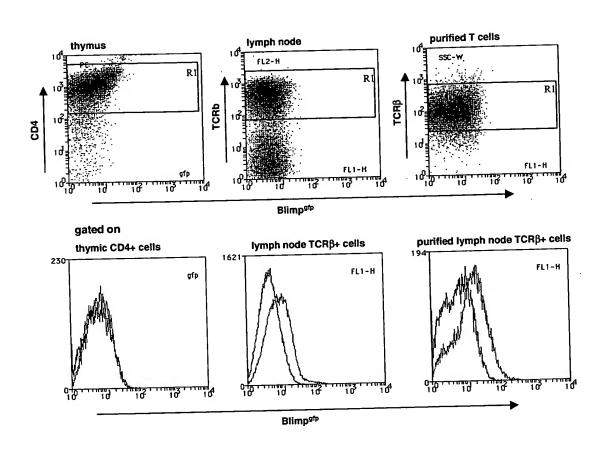


FIGURE 11

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 13 of 39

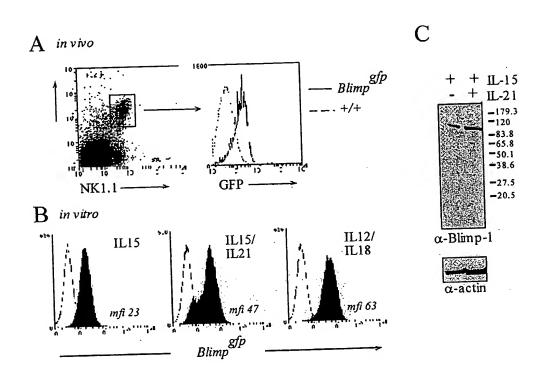


FIGURE 12

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 14 of 39

cactcggccctccagtgtcgcggagacgcaagagcagcgcgcagcacctgtccgcccgga gcgagcccggcccgcggccgtagaaaaggagggaccgccgaggtgcgcgtcagtactgct cagcccggcagggacgcgggaggatgtggactgggtggacATGAGAGAGGCTTATCTCAG ATGTTGGATCTTCTCTTGGAAAAACGTGTGGGTACGACCTTGCCAAAGGCTGCATTTTAA AACCGTGCTTCTTCAAGGCAGTCTACTTTACACGGCTTTGGACTCTTACTCAACTGTACA AGCTGCCCCAAGTCTAGCTCCGGCTCCGTGAAGTTTCAAGGACTGGCAGAGACTGGGAT CATGAAAATGGACATGGAGGACGCTGATATGACTTTGTGGACAGAGGCCGAGTTTGAAGA GAAGTGTACATACATAGTGAACGACCACCCCTGGGATTCCGGCGCTGACGGGGGTACTTC TGTTCAAGCCGAGGCATCCTTACCAAGGAACCTGCTTTTCAAGTATGCTGCCAACAACAG CAAAGAGGTTATTGGCGTGGTAAGTAAGGAGTACATACCGAAGGGAACACGCTTTGGACC CCTCATCGGTGAAGTCTACACTAATGACACAGTTCCCAAGAATGCCAACAGGAAGTATTT TTGGCGGATCTATTCCAGAGAGGGGTTCCACCACTTCATTGATGGCTTTAATGAGGAGAA AAGCAACTGGATGCGCTACGTGAATCCAGCTCACTCTGCCCGGGAGCAAAACCTGGCTGC CTGTCAGAACGGGATGAACATCTACTTCTACACTATTAAGCCTATCCCTGCCAACCAGGA **ACTTCTTGTGTGGTATTGTCGGGACTTTGCGGAGAGGCTCCACTACCCTTATCCTGGAGA** GCTCACAGTGATAAATCTCACACAAACGGAAAGCAACCCAAAGCAATACAGTAGTGAGAA ACTGGACTCCAATCCCTCCAAAAGGAAGGACATCTACCGTTCCAACATTTCACCCTTCAC TTTAGAAAAGGACATGGATGGCTTTCGGAAAAATGGGAGCCCCGACATGCCCTTCTACCC TCGGGTGGTTTATCCTATCCGGGCACCTCTGCCAGAAGACTTTTTGAAAAGCGTCCCTGGC CTATGGGATGGAGAGACCCACCTACATAACTCACAGTCCCCTTCCGTCTTCCACAACTCC AAGTCCCCCTGCGAGCAGCAGCCCGGAGCAGAGCCTTAAGAGCTCCAGCCCCCACAGCAG CCCGGGAAACACGGTGTCACCCCTGGCGCCCAGGCCTCCCAGAACACCCGGGACTCCTACTC CTACTTGAATGTTTCCTATGGTTCCGAGGGCCTGGGCTCCTACCCTGGCTATGCACCTGC CCCCACCTCCCACCAGCTTTCATTCCTTCTTACAATGCTCACTACCCCAAGTTCCTGTT GCCACCGTACGGCATTAGTTCCAATGGCTTGAGCACCATGAACAACATCAATGGTATCAA

FIGURE 13

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 15 of 39

GACTGGTTACAAGACTCTTCCTTACCCTCTGAAGAAACAGAATGGCAAGATCAAGTATGA GTGCAATGTCTGTGCCAAGACGTTCGGTCAGCTCTCCAACCTGAAGGTCCACCTGAGAGT GCACAGTGGAGAACGGCCTTTCAAGTGCCAGACCTGCAACAAGGGTTTTACTCAGCTCGC CCACCTGCAGAAACACTACTTGGTACACACAGGAGAGAGCCACATGAGTGCCAGGTCTG CCACAAGAGATTTAGCAGCACAAGCAATCTCAAGACCCACCTTCGATTGCATTCTGGAGA AAAACCTTACCAATGTAAGGTGTGCCCTGCCAAGTTTACGCAATTTGTGCACCTGAAGCT GCACAAGCGACTGCATACCCGGGAGCGGCCTCACAAGTGTGCCCAGTGTCACAAGAGCTA CATCCATCTCTGCAGCCTCAAGGTCCACCTGAAGGGCAACTGCCCTGCGGGCCCAGCTGC TGGGCTGCCTTTGGAGGATCTGACCCGAATCAATGAAGAAATTGAGAGGGTTCGACATCAG CGACAATGCAGACCGTCTTGAGGACATGGAGGACAGTGTCGATGTGACCTCCATGGTGGA GCAAAGAAACATGGGGAACGGCCTCCTCTCTCTCAGGGTGCAGCCTCTATGAGTCATCGGA CCTGTCCCTCATGAAGTTGCCTCACAGCAACCCACTACCTCTGGTGCCTGTAAAGGTCAA **ACAAGAAACAGTTGAACCGATGGATCCTTAA**gattttcagaaaataagtgtttcgtgttg cttcttagggtatggcttggtgaatcagggtgcctttagcaaattgcttgtacatgactc cagatctgcaaagctccgctggcaccgggtgcttccctgcacctctctggaattaaagaa ggactccaatgttaccaaaatctcagggcataaatgaggcaaagactcactatataca ttgaacctgtgtattttgaatatttgtgtggatatgtttgcatagcgccttcctattact aaaactattgcctagccataattattttttcaatgataattcttcataatttattataca gtttatctttcaaaaagcaataattaaagaagtttacaatgactggaaagattctttgta

FIGURE 13 cont.

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 16 of 39

 ${\tt aaagtaaaaacgggtattcttatcatcttaggttaagcgggtaatgaacattcctgtccc}$ ${\tt caacgcatcaactgtattgtatctgtaaaactcagcttttctcagtatttgtgtttttgc}$ attgtataattaacttaattaaagatgaaagggcattgcaaaagtgttcaacaattacct cattgagtgtatccagtagaagtgcaggaattaatgtcgtatctcatgagttgctaccca gctgagcgtgtgtgcttccaaatggtaggctgggtggttcggtcctgtattctcctaagc ccaaaggttacctgttggtgttcaaggtgtaataaagaatgctgtatatttatgaaccta tttataccagtataccatgtgtatatatgatatatttataaccacttaaattgtgagcca agccatgtaaaagaacctatttttcctaagagcaaaaagaatctctctgaagttttgctt aaaactccatgacctcgctatgactttggtgcttgggcaccaccctgcctactaccagag acaccatccagtcgcatttgatggccttgctacatgtgtgtcagttgggtcacagaataa $\verb"cctcctctagaaccctgactcatgctcactgctcagtctgatgcttaccttagagttttg"$ tatatatagatcaacttacaaagagggaaaacttcagatcctctggggggaaacccaagag ccttactgacctgttgctgtgactagctagatgggtttctcttttaccttccaaggatcaa aaccagagattccacacatgctagcaagcaagctgtcactgggctgcagcccaac

FIGURE 13 cont.

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 17 of 39

MREAYLRCWIFSWKNVWVRPCQRLHFKTVLLQGSLLYTALDSYSTVQAAPKSSSGSVKFQ
GLAETGIMKMDMEDADMTLWTEAEFEEKCTYIVNDHPWDSGADGGTSVQAEASLPRNLLF
KYAANNSKEVIGVVSKEYIPKGTRFGPLIGEVYTNDTVPKNANRKYFWRIYSREEFHHFI
DGFNEEKSNWMRYVNPAHSAREQNLAACQNGMNIYFYTIKPIPANQELLVWYCRDFAERL
HYPYPGELTVINLTQTESNPKQYSSEKNELYPKSVPKREYSVKEILKLDSNPSKRKDIYR
SNISPFTLEKDMDGFRKNGSPDMPFYPRVVYPIRAPLPEDFLKASLAYGMERPTYITHSP
LPSSTTPSPPASSSPEQSLKSSSPHSSPGNTVSPLAPGLPEHRDSYSYLNVSYGSEGLGS
YPGYAPAPHLPPAFIPSYNAHYPKFLLPPYGISSNGLSTMNNINGINNFSLFPRLYPVYS
NLLSGSSLPHPMLNPASLPSSLPTDGARRLLPPEHPKEVLIPAPHSAFSLTGAAASMKDE
SSPPSGSPTAGTAATSEHVVQPKATSSVMAAPSTDGAMNLIKNKRNMTGYKTLPYPLKKQ
NGKIKYECNVCAKTFGQLSNLKVHLRVHSGERPFKCQTCNKGFTQLAHLQKHYLVHTGEK
PHECQVCHKRFSSTSNLKTHLRLHSGEKPYQCKVCPAKFTQFVHLKLHKRLHTRERPHKC
AQCHKSYIHLCSLKVHLKGNCPAGPAAGLPLEDLTRINEEIERFDISDNADRLEDMEDSV
DVTSMVEKEILAVVRKEKEETSLKVSLQRNMGNGLLSSGCSLYESSDLSLMKLPHSNPLP
LVPVKVKQETVEPMDP

FIGURE 14

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 18 of 39

gaattccgggaagccagacggttaacacagacaaagtgctgccgtgacactcggccctcc agtgttgcggagaggcaagagcagcgaccgcgcacctgtccgcccggagctgggacgcgc gcccgggcggccggacgaagcgagggaccgccgaggctgcccccaagtgtaactcca gcactgtgaggtttcagggattggcagaggggaccaaggggacATGAAAATGGACATGGA GAACGACCACCCTGGGATTCTGGTGCTGATGGCGGTACTTCGGTTCAGGCGGAGGCATC CTTACCAAGGAATCTGCTTTTCAAGTATGCCACCAACAGTGAAGAGGTTATTGGAGTGAT GAGTAAAGAATACATACCAAAGGGCACACGTTTTGGACCCCTAATAGGTGAAATCTACAC CAATGACACAGTTCCTAAGAACGCCAACAGGAAATATTTTTGGAGGATCTATTCCAGAGG GGAGCTTCACCACTTCATTGACGGCTTTAATGAAGAGAAAAGCAACTGGATGCGCTATGT GAATCCAGCACACTCTCCCCGGGAGCAAAACCTGGCTGCGTGTCAGAACGGGATGAACAT CTACTTCTACACCATTAAGCCCATCCCTGCCAACCAGGAACTTCTTGTGTGGTATTGTCG GGACTTTGCAGAAAGGCTTCACTACCCTTATCCCGGAGAGCTGACAATGATGAATCTCAC ACAAACACAGAGCAGTCTAAAGCAACCGAGCACTGAGAAAAATGAACTCTGCCCAAAGAA TGTCCCAAAGAGAGAGTACAGCGTGAAAGAAATCCTAAAATTGGACTCCAACCCCTCCAA AGGAAAGGACCTCTACCGTTCTAACATTTCACCCCTCACATCAGAAAAGGACCTCGATGA CTTTAGAAGACGTGGGAGCCCCGAAATGCCCTTCTACCCTCGGGTCGTTTACCCCATCCG GGCCCCTCTGCCAGAAGACTTTTTGAAAGCTTCCCTGGCCTACGGGATCGAGAGACCCAC GTACATCACTCGCTCCCCATTCCATCCTCCACCACTCCAAGCCCCTCTGCAAGAAGCAG CCCCGACCAAAGCCTCAAGAGCTCCAGCCCTCACAGCAGCCCTGGGAATACGGTGTCCCC TGTGGGCCCCGGCTCTCAAGAGCACCGGGACTCCTACGCTTACTTGAACGCGTCCTACGG CACGGAAGGTTTGGGCTCCTACCCTGGCTACGCACCCTGCCCCACCTCCCGCCAGCTTT CATCCCCTCGTACAACGCTCACTACCCCAAGTTCCTCTTGCCCCCCTACGGCATGAATTG TAATGGCCTGAGCGCTGTGAGCAGCATGAATGGCATCAACAACTTTGGCCTCTTCCCGAG GCTGTGCCCTGTCTACAGCAATCTCCTCGGTGGGGGCAGCCTGCCCCACCCCATGCTCAA CCCCACTTCTCTCCCGAGCTCGCTGCCCTCAGATGGAGCCCGGAGGTTGCTCCAGCCGGA GCATCCCAGGGAGGTGCTTGTCCCGGCGCCCCACAGTGCCTTCTCCTTTACCGGGGCCGC

FIGURE 15

CGCCAGCATGAAGGACAAGGCCTGTAGCCCCACAAGCGGGTCTCCCACGGCGGGAACAGC
CGCCACGGCAGAACATGTGGTGCAGCCCCAAAGCTACCTCAGCAGCGATGGCAGCCCCCAG
CAGCGACGAAGCCATGAATCTCATTAAAAACAAAAGAAACATGACCGGCTACAAGACCCT
TCCCTACCCGCTGAAGAAGCAGAACGGCAAGATCAAGTACGAATGCAACGTTTGCGCCAA
GACTTTCGGCCAGCTCTCCAATCTGAAGGTCCACCTGAGAGTGCACAGTGGAGAACGGCC

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FIGURE 15 cont.

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MKMDMEDADMTLWTEAEFEEKCTYIVNDHPWDSGADGGTSVQAEASLPRNLLFKYATNSE
EVIGVMSKEYIPKGTRFGPLIGEIYTNDTVPKNANRKYFWRIYSRGELHHFIDGFNEEKS
NWMRYVNPAHSPREQNLAACQNGMNIYFYTIKPIPANQELLVWYCRDFAERLHYPYPGEL
TMMNLTQTQSSLKQPSTEKNELCPKNVPKREYSVKEILKLDSNPSKGKDLYRSNISPLTS
EKDLDDFRRRGSPEMPFYPRVVYPIRAPLPEDFLKASLAYGIERPTYITRSPIPSSTTPS
PSARSSPDQSLKSSSPHSSPGNTVSPVGPGSQEHRDSYAYLNASYGTEGLGSYPGYAPLP
HLPPAFIPSYNAHYPKFLLPPYGMNCNGLSAVSSMNGINNFGLFPRLCPVYSNLLGGGSL
PHPMLNPTSLPSSLPSDGARRLLQPEHPREVLVPAPHSAFSFTGAAASMKDKACSPTSGS
PTAGTAATAEHVVQPKATSAAMAAPSSDEAMNLIKNKRNMTGYKTLPYPLKKQNGKIKYE
CNVCAKTFGQLSNLKVHLRVHSGERPFKCQTCNKGFTQLAHLQKHYLVHTGEKPHECQVC
HKRFSSTSNLKTHLRLHSGEKPYQCKVCPAKFTQFVHLKLHKRLHTRERPHKCSQCHKNY
IHLCSLKVHLKGNCAAAPAPGLPLEDLTRINEEIEKFDISDNADRLEDVEDDISVISVVE
KEILAVVRKEKEETGLKVSLQRNMGNGLLSSGCSLYESSDLPLMKLPPSNPLPLVPVKVK
OETVEPMDP

FIGURE 16

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AGGAGGGACCGCCGAGGTGCGCGTCAGTACTGCTCAGCCCGGCAGGGACGCGGGAGGATGTGGACTGGGTGGA CATGAGAGAGGCTTATCTCAGATGTTGGATCTTCTCTTGGAAAAACGTGTGGGGTACGACCTTG tctccccctccccttttaaaaaaaaaaaaaaaaagaatgaagcctcagtagaaaccagcgcttctgttttagtac gcggagcactgtcaaacatttagaagacttttttcctccgtatgaatcattaaccctttcagttctagacata attgtcaattcactgaaatttcagtagtggttcttgtccgcttcgccactcgctgcctttacattactgtaac ${\tt tatcccgggttgacttaggttttcacttgtatttaacatcgtttgttccacatggaccttacatgttggaact}$ aaataagaatgagatagtttaagttgtacccgggacaaggacaagtaagcatctttccccttctcggagcgtc ctatctagggacgaattgtaaagaccagctccggagagggactcccgctgtactgtgtttacattttcacaag cgcgcgttctaacatggttatccttattcctaatttttatctgcggcgtctatgtgggaatacgttgcagagg $\verb|ctgttttatctttcttgcttttcctctttggaaaggactttttccgagggcagataagaggaggatccccaag| \\$ tcttctgtataactttagttacagtaaactgtgccacttcagtgacttctgggaattcatgcactttcacatt taaatagaaagtgctatttgtggctgagggctcctaaaggaattctcttcagggaattctattgactttttt gggtgtttccctcttccccaatttttcttttcctgtggtccatgggagctcgggaaggctggtactcaaggat cagagggaggggacctagttgttttgaaagttgcttcgctagggagctggtgggaaagttcagttttccccat agcgcccctgcctcttcctccccttgtttgtgacacttctctgagacagcttttccacagctctgagggtctg gcggccatgaccccgggcgtcccgggacacaggacgcagcagcgcccacaacacatttctgccttgagtgata aagccaaggattgttcaaaggtagctgttctttctctcccgatgaggttaacatatacatatacgctttttt tttttttttcagCCAAAGGCTGCATTTTAAAACCGTGCTTCTTCAAGGCAGTCTACTTTACACGGCTTTGGACT CTTACTCAACTGTACAAgtactccaagcttttaaagtcttcagagcaccgtgttagtcatagcctctaagagg gaggcacaggagcgccggacaatggggattaaaagcctttcccttctcttccag**GCTGCCCCAAGTCTAGCT** CCGGCTCCGTGAAGTTTCAAGGACTGGCAGAGACTGGGATCATGAAAATGGACATGGAGGACGCTGATATGAC GACGGGGGTACTTCTGTTCAAGCCGAGGCATCCTTACCAAGGAACCTGCTTTTCAAGTATGCTGCCAACAACA **GCAAAGAG**gtaagccggctgccttcttgaagtctgactggcaattgggccagctctcctactactatctctga gaaccgtgagaatttatatgcattggcaaataattgatcgctccagtggctgttttccttgctttctctcaa accaattcctattcatttcttcctcccttcagctgtcctatactaattagtaaacagttaaattttttggcaa gttgacatgtcttgggaaagctaactggcagcactggtgggcagcatggtaaagggctcagtgcttcaccccc tggccctcttggatgacagttttaaaggaaagaaacttccttagaaaaagaagtttttcctctgctcatgaga tggctttattcttttaacgagccagctttattagctgggtttctaaaattattctcaaaaccttgacgtgttt atgaactgaagagatggcattaaccaggaagagggtcacgtaaaagtgtcctctgtcaggatgacttcactaa ccaccctttacctgtggcagctccctggcctgggccaggccggcaggtccatgttttatggcttctgaagtgg gtacactctttgtatcaaagacacagaacacctgaggagcacctgatttgtgtttatataacaattagagtcg gctgtgaagtgatttgcaaaataactccttgctctgagaatctggctgctgcagttgctctcctgatggctta agttgctgaggctagccctgaggagacttcccaccatcaccattgcccacagtgctgtggtttctgatccttg nnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnaaggagggattctgtgtaaggattccagatttgctccta ggactatgcattatgaaagtgccaggtcactttcctccttccctaagcgacaacatggngaaagaaactccag caaagaccgagagctaaacttaaagagaggaattctaccttgtgtttcactaaagctccactctttgttctat ttctgatgggagacttatttgttttatgaaaagcaaattttaaattgtagtttgtgtataaataccaccaaaa aaaattgtaaccccagaggtcacccttaattatacctctttctgaaaacaatgttcttctcaacagaaagcct gtagtgtgttctccccccatcagatttgcctaaatattggtcccttcaaaaagggccattcatgtcctgttgt $\verb|ctctgtagcctgttgggatagaaataaagactcctggttttttgtcatcggctctgttctccttcagagtcct|\\$

FIGURE 17

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tggaggaagtgtttacattaccattgttcagttagttcggtgagttccatgagctgtagaaacagggaaaggc ctttctacgggtagcttttatctgactgatctggcttgcccatctttaaatgttttcattaaaatagcaaaag tcattatgaatttgtgctatgtgtcagcaccttcccacccccacccccaccccttgatttaaaaacaaaaca tgcaaactgtatttctgatcttaacatcaatttttagctctggctcagaatcattctgttcttttattggggc cgtttgatcattcttacttcctatttccagatctaaaaccaagtacaagcacactcttcaaaacttttagaac gtttaaccgggtgggttcttcttccgtgggatttccccctcgtcctcctgaaataatctctgaatatttgact gcattaaaaaaaaatcagttttgacattgggagagcagtatccaggacaactttctgctgtcagctgaggtgg cttgtcctcaggcactgtgtggctcctctgactctggtctgaagttgagtggtgacaaacatcaggcagatct agggacatggtgtccattctgattgaagtccattattaaattgagccatctgtatggaatctcagcacaacat gcaattccacctccggacttttttatttggtagtatgtgccagagtgccaccacatctcccttcacataaaga taacacgaagcaggagacctttcaaaaacacctgctaattcctttgaaaactggactgaagtacagacttgat atctcggtctatacccttatagtaaaaatacaggaaaggaaatctaattgttgggcgagatttggggagggga aaaacagcaagtaattaaagtaaccttaatttgaagtgaggaaactcaggccacttttggaactgaatagtgt gcaaacaaacagacctatgctgcccttatcatccgactttcattctgtactcccactcccactccatcc tgcactgtaggaatctttcttttctaaagttaaaaagaagctctgctttttgtctctgagctccagtttgtgt ccatgaagagcttccgtggggctgaagcatgggcagcctaaggaggcctctttctcttcctgatgggtgtagg cagttaggtgagcacactcttggtctttttagcagtgtgcaactcaaagcacaggtcaagtttctctgtgccc tctgcttgttcctagggtagggcactgtaaacaatgggttaggaagatgggttgggctaagacactcatctgg atcagtttcctgctttccattaagaacaaccctggctcttacccccatcctaagacaccccacaatcaccata ${\tt accttagagccgcagtttctatgtcttctttgattaaggaatcagacatggattagacgtgaaggtgtttatt}$ gtgtgttgttagcatgctgaacttgagatggctataggtggtttatttgatgttcttttttctgagatagaat cttgagatgtctgtagtcggaatgcaggccacaagctgctgatcttcctgcatgctatgattagaggcatgca ccacaccacctagtgagacaggtgatttcgaagctacagggttcctctaacctcagaatgctgaattgtgt gtctctgtttacctatcagtgtgaatttcctcgtgttcttcagctctgtgtatagtaggaattttaaatatca aggtcctattgtactcataaaaacaatctaatattgcattttggtctggttatatttcccagactgaccttgg actcaataatctcttgcctctgcctcagagtggctgggacttgaagccaccccagaatttctggttactcctt tttctctcattcacatgacttgtctgttgagttgcatttgtaaggttaaagatggcaggcgctccaaacactg tctcccccccccccccaagattctaaataacttccttttggccacaggacaatgtgttttgttagcgtta aaatcggtaggtgaaaaccaagcgtctcttctgtagagagaatggcaatctggaagggaagctgtgacctcat tgtactgctccttgttggtaatcaagctctgactcccaagaaactgtgcgcaggaggctataatttaaaacaa agttgatgaaccagtcgagtgcctttcttaaaattactgctttaaagtggatatgttgaaattatcagctgct aattattggctccctgacaaatggcattatttgtttttcctgcttggcattttaatattatggaataagcatt caaatgtaaatgtctaataatttgtgtattatagaagacaattccatggattttacagagtgggttcaataat tcacccgaacaagcctgggaccggaaagtgtagtcaagcattctgtgtaaaaatttatctccagagtctctgc tctgagatactcttgttcccccaaagctaggctaccagcagacaccaccaatgaggaggtgtcttggaagcat

FIGURE 17 cont.

agacaggtgtgacgagggcagaggaggagacgaacatctgctttcttcagacctttgccacaaattcaaacag gaccaaaaataacacctttaactcaacgaatctgtttcgaattgtgctggatatagagaatttctcctctccc ctttcctgtcttaagaatgccctgttaacatgtattgaatattaaattatttaacaaaatggcatctgacgat aaaaggacacctgtcatgagagtggcctgtccccactcttcatgtgtgtttattccacactagacccgagttt taactatggatgaggctggataccagtgtgtatcacagtccaagtctcagatttccactcaaactacctgaag agacattgatttgcttctctgcacctaccattcaggaatataatcataggagaaccgtcaacaaaaaaagcca agtaaagataaatgctgtgcattgccttgccctggctcacctgccactgtgaaaggggtacagagtcactctg aagaaagttatgctcaaggaagaatgccatagttaatgtgtttcttcagcaaaccccacagagtcagagtgtg tgaggccttcagtttgaaaaggtcatttcctcagatcttagaagccacatcttttagaacccacagtctcatt acatattccatttcaaagagggacttctgaccaccattgagtagatgttggagaagaacaaagttacttgaaa gatctttctagtaaagagcccttatgagctataagccaaaggggatggagatgtcaactggaattttaaaaaa acaacaaaaaccttaatgtgtttggtttctggttccctcggcctctatggaacagctaaagagcattattttg gtttctgaggttaaaactcttgcattttcctcaagcatggtgtttatggtttgagggagaagactggaactag gaaagcagtccgtccccgggactatttcagtttcagcacttggatgactgtaaacgatgactgtcacgaagct MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 23 of 39

AAGGAGTACATACCGAAGGGAACACGCTTTGGACCCCTCATCGGTGAAGTCTACACTAATGACACAGTTCCCA **AGAATGCCAACAGGAAGTATTTTTGGCGG**gtaagtaagaaaaccttttttttaagacttttcactataggggg taaatggagcttaaagaacaggctcagttccctttcaacacagcagggctcacccagggaaacactggaattc tgagcaagttccctagaactggttaaacgctctgcctagaatattagctggaggtggttagatgtggactacc gggcaggctcatttgcatttctcttcgaggaagtagtaatgagtcacggagacttacatttcaccctttcttg atttcttgctgagttaacttcatttgaatggaagagttatcctgagtgaacttgatgtcgaagacaaatgtca ccataaaacggttacatttgacagtatcatagttgttaagcatgaggaaaatcctcgtgtgcctatgagattg tagactcaggtagaataactattctaaaggtctggcctatgctatctcctttggagtgtcagggttagcgagg attctgaggtgacctgggagatgggattcatgggtaaaaattgttctctgagatgtctctggcatgttcagtt ttcctcagtgtagaaatgaagagctatttatacaaatttagtgagctgttttcctcacacagacatgaaatat acaccacccagagaaatggtaatatccacaactggattacatgagaaaaagactttggttaaaaaattactta ttcctgagagagtctgtcttcagctaggaagtctttgtttccagaaacgtactacttctacaactgcatctgt agtettgttaagtatttgttetcaatttttatttatttaatacttagttggtgttaaattatattgeteeaag atcgcagtctgagattatgagcggtttcgcccttattgctgttctcagatgggagccaccagtggtagattaa tcttggcctcagctggtatgaatgaagacaatccgacactgtcgttttgaaaacggtcaagaagcaccaaagg ctctcccattactgtccccactgtcccatttaaagatttacaaaaagaattagactaaataactagaaggctt agatcctgatttgtcaagcaggaataggaacatctctgtgttgtgaggaatgaaaggttgtcatgcaaattac acagtcagagatgctcaggttgagaaagcagtgacatttcttgtaactgtagtatgaatcagcttgtgtttag tettettgatactggatggaaaggetggtataagtgtgeettttacaaaagcatgatgatagtttettggggt gcgtgtgactttcacgacatccaaggtcctttttttaaaacaaggatacagtaaaccgtagccatgaaaggc ctactgggatcggcacaccctctgctagctgtttccaccctggtgtaagggcgatggaaccccttgttcctgg aagtttgcgcgtcagagtaaacaaacttgaaaacccctcttgatagcagaatccagtcggtcttgttacattt tetettaacaagatacacegeggaagetetegcaggetgetttgatgaagecacacgcacececcacacacac ${\tt acacacacacacatacaattcacaggaagtctctctttaaaagaaactgattctgctgtttactgcctgtgtta}$ aagggacagagttccttttttatttctgataacgttagagggaaatacagaaacgttcacacagcctgtgtgt gactaagaatacagcaaatagccctgtagagcaaactccctgaggtgagcatggaagcgccgtacctcttgga

FIGURE 17 cont.

ggagaggatgaggagtgagtctttgaccccttggtttcagtaggagtgtatttctcccctgctcttaactatgcctttaaccaagcactctgagtacagctgtgagtcagaggtagcattgctgaagaagaaccatatattttctt tatgggcaaatctctctactccttttcaagagagaggcacagggtggccgcctgtgtttaccaagaggaaaag ttacttctcgataggctgtcaaactttggcctccgtgccagtgcctcactctgttatggcaggtgaagttcac ctttgccccacccagtgtttccacaaaaaggcagggttccaagtattcatctgaacaagtgttactgtgggac gaggccatagaaaaaaggtgagactcagtttgacgcagtcctctcggctgctgtgcccagtgactcaaagcac tagaagtcagcagagttggaactctgggctgagcagagtcgcctgatcgatattcgctactgtagcaagagta cctctttatggtagtttcacccactctcggctgttgttaattggaatattattattattattattatttt gctatccactgccctccccaacatgagaagaccataaaattgaaatggaaaggtaactagcacaatgtgccct gtttcctcccccatttctgctgattcagcgtgagtcccaccggatcagcaatgaggcctggagtcatgggtac agcgttggttgctcgcctgtgttccttctgagccattcagggaagcttcccggtcgctttgggctggccggct gtctttcacactgcatctatcctctcttttgaacagATCTATTCCAGAGAGGGGGTTCCACCACTTCATTGAT GGCTTTAATGAGGAGAAAAGCAACTGGATGCGCTACGTGAATCCAGCTCACTCTGCCCGGGAGCAAAACCTGG CTGCCTGTCAGAACGGGATGAACATCTACTTCTACACTATTAAGCCTATCCCTGCCAACCAGGAACTTCTTGT ${\tt GTGGTATTGTCGGGACTTTGCGGAGAGGCTCCACTACCCTTATCCTGGAGAGCTCACAGTGATAAATCTCAG}\ {\tt t}$ aagtggattccagaccaaaaaaaaaaaaaaaaaattaaaaatgctagtaatgtcagttctgccctgtgagct aataacatgttgtctaattatacggcttcgtcatgtgttggactaagtaggtggctttagctaagacgaggaa gaggaaaaacattctttaatgtccctacttcttattataaaacataatcatcaaagatatacatattacatat attgtataaaataaccagtacagaatgttgttttcggaaagttgcaggaagaagtatatttccgattctaatt tatgcaagcggctgtaggcacaatcccaatgggtatggacctgtggaacaggccagctgcagtcccttcctgc tgtgctgggtcagagctttgagttttcactgaaatcttgtgaagatacgtgtgcctgtaaagccatgatctaa tgtggaaagctgttttctagaaaaaaaaaaaaactgtcataattgttcaagtagtctaagtgaataaccct aagagatgtcatatctgagcttccttccttatggtaaaggggactgatctcatctttcaatcaggcttacggt aaccgcctatctctttatcttgacaaattcttgcttccttgggtttataagcttttacttttcttcttct actgccgaatcttacagcactttttcaaatgaccatcttcccatgaaagctaaatgttgaaggtttaaaagtt MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 24 of 39

ttcattttaataqtctctqaaatttqaqtaaacatttccagaaatctatagagagttccaagctagactttac ccagtttctactcttcagtctcatttgctttccctggagactaaatgtagttcatattttaccactgaagcac tagaaatattaattttagtattttaacttttaagaccaaggacagtgtctcgctagccatgttcattctacaa tgcttgtgctctcaggaattttcagttttctgaaaatcttagcttcagtacctttcctgtaggctcacaatat aggtctcqtqctqcttagqttcaqttcagacttgatgtagtcagggaaagccttgagccactgtcacctccaa aatgctaggatcacaggcctgtgccctcccccaccctgcctcccaccatcccccaatgcctgttccgagt gtttactctttgtgtccagaagtaagtttcattatgctatgaaatgacagctttgctcttcagacacccccc ccttttgactgatqcaqqaqtcttctgagggtcacaggaacacctcctttgtctgacattcctaggacagaaa gagagttaaccattcagctgccgtgcaaggctcttgctcctgattgtgaaacctgttggcccaggtgtggcca ctgatgactgacactctgatcaggaaaatttccagcatttcatcaggcctaataggcagatcgagtgtccaag atgggctgtgctagatttccaggcttaaagcacaatagaggtctgtccagaatctccgtaaggacttccatca tqqqqtqcaqqqqatqqaaacctaatqaaaqaatgtaaqtccccagaaatcacaaactgacaggaaagagaag $\verb|ctatctatctaacccatctagaaatcagttgaccaaattatagacttctgaatgttaatctgctttctc|\\$ $\verb|cttattatagatcgaaaatgtgagtcggcataattaagccattcagaaccttccaaagcagctcactcttqaa| \\$ atgactctgtccgcctacagccatttaagatttaagaacaaaaacagatcttgattttctttttcatgttaGc tcaagctgctaagtgggagagttagaaatgatatcagctcctgtgattagtcagctgctgaaggatgagtttt

FIGURE 17 cont.

taaaaatgtaccttcatatacagtctataatttccagctgtaaagtattttagagactgacattttgctgcggatattccttcaqqataaqttctcaqcctqqttgtttgtttgtttgtttgtttgtttcttgaagacagagccac caaacgctaaattatgcatgtcacggagaaaatgaaaagctctgacttcattgtttcttggttcagtcattag $\verb|cttcacagtagttcagtaactaaagtgcttagcaagaagagagccgattaaacctgtgctctacactggaaga|\\$ aagcccaattctttatacttaacagctttcatttqttaagtttccactqtgggactactacaaaaacattatg $\tt gtgatcgagaggcagacgctggtggatctctttattcttggccagtccaatctatataacaagttccagacct$ actgagactgcacaataagtcttcccccagaacccccatcaaaaaaagagcagagttaggaaggccgtacaca agcaggettg cacactete acgegete cgetete gegegee cacacacacacacata cataggeata egeacatgeqcacacacttcttttctcttaacctgagggtgcttctaaaatcattatctttttgtcttacctccagtaaat $\verb|ctgataaggggatatttattttggttgagaggcttgagaaattgctctcccccagaaagctttctgtcactga|\\$ cccatcaacatctcccctgatagtgttgtccacggtgtttattctggggctctggcttacccaggagtaact $\tt gataacagccagcaggagataacgtcct \bar{g}taaagcgctttccgactggcatcaaatccctccagcctgtcagc$ ctggagaatggatctgaaagctttagttctgggcttccacagagttcatcttcagacctatcaggtagcaagc ttggagttccttctcagttaagcccaaaagggctgttttataagagcacaaaggatacttctttacattgtct taagtgtcattccaaacctgccagatcttggaggtcaagaatcttgtttctactccgagcatgtgcacccccc aactaatgatgctctcagcatcctggggagaagtgcctgtttgaatgagcatcccagaaacacactcagcct gtgcatcggatgtgttttatctttggcccaggaaagctgagctgaggcttttcctgcgaaatagggctacata actatggacagtttaggacagtattctccttgtctgagcttgaccagggcatatatgctgtctctaggagtaatggtttggcagaggtgactgtcacacctcaCgattccaggagacagcccagatggtagtctggttagaccaga ${\tt accttggtgaaatgctcgcactgccgagcaatggctagaaggggcagccgccatgcccttctagttgatacag}$ gcaattcgaacagggctcatgaagttcctatgtaaagagaatcgagttggaaattgatgacagttcattactt aaaactagtcttaatctttcatctaagtttgcacagcaCtctgatttcctctaggtaaactgcgaatgactta $\verb|ttaacccgtgacaacccccacctgtatttttccaccccatcttagtgaacgctctgcccgttccagtttg|$ aacagcacttttctatcctagttctcactaatggaaaggagatcatccaaggggcactgggctctatggaggc ctgagtgggtggcccagagccctccctccggagtgagaggcgttaggggccaggtgtctagcctttgtatttg ctgctgctcagggtttctcaagaagagagaatggctttctgatttcacttcagttctccacagccctgtgagt aaccgccctttcttcttcattttagCACAAACGGAAAGCAACCCAAAGCAATACAGTAGTGAGAAAAATGAAC GGGAGCCCCGACATGCCCTTCTACCCTCGGGTGGTTTATCCTATCCGGGCACCTCTGCCAGAAGACTTTTTGA AAGCGTCCCTGGCCTATGGGATGGAGAGACCCACCTACATAACTCACAGTCCCCTTCCGTCTTCCACAACTCC AAGTCCCCTGCGAGCAGCAGCCCGGAGCAGAGCCTTAAGAGCTCCAGCCCCCACAGCAGCCCGGGAAACACG GTGTCACCCCTGGCGCCAGGCCTCCCAGAACACCGGGACTCCTACTCCTACTTGAATGTTTCCTATGGTTCCG AGGGCCTGGGCTCCTACCCTGGCTATGCACCTGCCCCCCACCTCCCACCAGCTTTCATTCCTTCTTACAATGC MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 25 of 39

FIGURE 17 cont.

gtggtttcttcccaggtccacctgagagtgcacagtggagaacgacctttcaagtgccagacctgcaacaagg GTTTTACTCAGCTCGCCCACCTGCAGAAACACTACTTGGTACACACAGGAGAGAAGCCACATGAGTGCCAGgt gggcagtattctctgggtagaactcttgacctctgtggaaaagtagctgtagaattgtcttcctgtgttgttt caacaatacaaaaaatatggtcttgtactaggctgctggccctgcacagctcctgggtactctgtgactactc agaggettetggtetecegaggtttetggetattggeetgeettteecentecagetgeaaacaattaatett ggtcttcccntgtgccctttctctgtcttcccttgccctcacactttagGTCTGCCACAAGAGATTTAGCAGC ACAAGCAATCTCAAGACCCACCTTCGATTGCATTCTGGAGAAAAACCTTACCAATGTAAGGTGTGCCCTGCCA AGTTTACGCAATTTGTGCACCTGAAGCTGCACAAGCGACTGCATACCCGGGAGCGGCCTCACAAGTGTGCCCA GTGTCACAAGAGCTACATCCATCTCTGCAGCCTCAAGGTCCACCTGAAGGGCAACTGCCCTGCGGGCCCAGCT GCTGGGCTGCCTTTGGAGGATCTGACCCGAATCAATGAAGAAATTGAGAGGTTCGACATCAGCGACAATGCAG ACCGTCTTGAGGACATGGAGGACAGTGTCGATGTGACCTCCATGGTGGAGAAGGAGATTCTAGCTGTGGTCAG AAAAGAGAAAGAAGAAACCAGTCTGAAAGTGTCTTTGCAAAGAAACATGGGGAACGGCCTCCTCTCAGGG TGCAGCCTCTATGAGTCATCGGACCTGTCCCTCATGAAGTTGCCTCACAGCAACCCACTACCTCTGGTGCCTG ${\tt TARAGGTCAAACAAGAAACAGTTGAACCGATGGATCCT} \underline{{\tt TARAGGTCAGAAAATAAGTGTTTCGTGTTGCTT}$ $\tt CTTAGGGTATGGCTTGGTGAATCAGGGTGCCTTTAGCAAATTGCTTGTACATGACTCCAGATCTGCAAAGCTC$ ${\tt CGCTGGCACCGGGTGCTTCCCTGCACCTCTCTGGAATTAAAGAAGGACTCCAATGTTACCAAAATCTCAGGGC}$ ATAAATGAGGCAAAGACTCACTATATATACATATATACATATATACATATTATAAATATATATATATATATT TTACTAAAACTATTGCCTAGCCATAATTATTTTTTCAATGATAATTCTTCATAATTTATTATACAGTTTATCT TTCAAAAAGCAATAATTAAAGAAGTTTACAATGACTGGAAAGATTCTTTGTAATTTGAGTATAAATGTTGTAT ${\tt CTTTGTCCTGTGGCCATTCTTTGTAGATAATTTCTGCACATCTGTTTAAATGCCTGAGACTTAGAAGATAGCT}$ ${\tt CTGTGATTTCAGGCAACCTTTCTCTATGATAATGCTTTAAAATGAGGTTTTGATATTGCCAAAGTCATGTGGT}$ TGGTGTGTTAACTCAGAAGATCACACAATCTGAGTGACATTCTCTAAGTTGGGGATACATGTGCAGAATTGCT CAGCAATAATTTGAGGGGAAGGAAGAAAAAATATTTTATGTTTCAGAATGATGGTTTGGTTTTCCTCCTCC TAGTCACAATTTTACCAAACAGTGACAGGAAGGCTTTGCCAACCTGTCTCCCAATGTCACATGACCATTCTGA GTGGCCATATGACTTTGGCATCCCTGGGTGTTATCTGAAAATGTGAAGAAGATAAAAAAGCCGTGTTCAGAAG TGTTGGCTTGTTTTTGTTTTTTAATATCAAAATTGCACAAAGCTGGTGCCCTACCAAGAAGGATTTGATATA GAAAGGCTCAGGCCACACTTAAAATACAAGCAAGCAAAGAGAACAGAAAAAAATAAAAGTAAAAACGGGTATT CTTATCATCTTAGGTTAAGCGGGTAATGAACACTCCTGTCCCCAACGCATCAACTGTATTGTATCTGTAAAAC GTTCAACAATTACCTCATTGAGTGTATCCAGTAGGAGTGCAGGAATTAATGTCGTATCTCATGAGTTGCTACC CTGTTGGTGTTCAAGGTGTAATAAAGAATGCTGTATATTATGAACCTATTTATACCAGTATACCATGTGTAT AGAATCTCTCTGAAGTTTTGCTTAAAACTCCATGACCTCGCTATGACTTTGGTGCTTGGGCACCACCCTGCCT CCATCCAGTCGCATTT

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GGGAAGCCAGACGGTTAACACAGACAAAGTGCTGCCGTGACACTCGGCCCTCCAGTGTTGCGGAGAGGCAAGA $\tt CCGCCGAGGTGCGCGTCTGTGCGGCTCAGCCTGGCGGGGGACGCGGGGGAGAATGTGGACTGGGTAGAGATGAA$ CGAGACTTTTCTCAGATGTTGGATATTTGCTTGGAAAAACGTGTGGGTACGACCTTG tttttttttttaattctgaaattgatctgaaaactttattttcttttcctttattgttattattattattatt tttggctaatgtcgcagtagaaacatgcttctgctttagtgcacttagtgctgtcaaacatttgtgagacttt ccttatgaatcattaaccctttcagttctagacataattgccaattcattgaaatttcagtagtggttccagc tcacactcgtcaaactattccgggttggctgaagttttctattttattttattttaacatgtgtttggcgtc atgactctacatgttggaactaaataaaaataagcaggtttgcttaaatcataactgagggaaaaacaacttt gcatccaacttttttttttttaagagcatcctatttagagaagtggaagaatgtaaaaacctccttgaaggac ttccacagaatgttatgtttacatttgaacaaacacacttcttacatggaaatgatacccatattcctcatt tttatcaaacatgtctatatgagaaaacccttacagaagttgtttacctttttttgcctttggaaaacagttt $\verb|ttttctgagtgtgagggaggattttgggggaatatcctcatcaatgtacaagtggaagcagagcttgtcctcc|$ aagtettetaaatttgttataaetttagttacagtaaaetgtagtacateagtgaettetgggaatteataea ctttcagatttaaatggaaagtgctatttgtagctgaggactcctaaaggaattctctcccagggaattttatt aaacggttttatgtttttgtttttgccttttcaatttggtatgagatgcttgcaagtcagaagacactgcaggc tgttttccccttcacccatttttcctcctcttttcctgtggtccaagtgatttctaagaggccgtagctcagt ggcagttgttttgaaagttgttttgcgttgggagctggtgggaaagttcggtcttccccatttggaaaaggca tcttcctctccttgtttgtgacacttttctgaggcagcttttccacagtgccgagggtctggcggccatgacc ccaggcattctgggacactggactgtgtgcccagaacatttttctgccatgagaggtaaagccagggattgtt ttaactaagagtagcatttaaaaaccttgcttcttttcaaggcagtttactttatacggcttcttggctcttt ctcaactgtaccaagcactctgcatctgcttttaaagtcttcagactactgtattagtcatagcctctcagaa $\tt ggagccacaggaacggcgggacaatggggattaaaggcctttcctttctcttccag {\tt GCTGCCCCAAGTGTAA}$ $\tt CTCCAGCACTGTGAGGTTTCAGGGATTGGCAGAGGGGACCAAGGGGACC\underline{ATG}AAAATGGACATGGAGGATGCG$ CTGGTGCTGATGGCGGTACTTCGGTTCAGGCGGAGGCATCCTTACCAAGGAATCTGCTTTTCAAGTATGCCAC CAACAGTGAAGAGgtaagcctctggtttattgacaagaagattggggacctggtgccaaatctccctacttgc aattettgcattgctttctctttccctaaaccatttccttctcatttcttccagccttcaactgttcctcact aattgtcagtgaacttcaagaaagctctgggcccactggccctagtgtccctgttgtacaatatctcttaagg ctttttaacaagccagctttattagctgggtttctaaaactatcctcaaaactttgacgtgtttatgaagtga gtttatctgcagcagctcctttgctggggctgggctggccaattccttactggcctctgaagtgggtac actctttgttgtttcaaaggggatgaaaacccaaacttggaatgagcaactgatttgtgtttacctttaatat aaagattatagctaggcgtgatgtttagctgtgaaataacttgcagaaccacctcttgttttcagaatttggc gaaatccagaatttgctactgggactattccttacagccgtgtcaaatcactttcccccttccctaaggaaca gtatttgaaggaatccgggagactaggaaatgctttgtctctttcctgtttgtgtgtctgagtccagtgtttt ctgcgtgaatggaggcagattttataaaaaataaaatttaaattctagttgtagttgaatgttaccaaaaaat ttaaccccagaggtcagccttaattatacctcttcctgaaagtaatgctcttcttatagaaagtctctcaata tgtggcccttggaatgaatgtaggatttgtttgggtatatgaggtttgactatggctttaaaaagtgtagtgt gttttttccccatatcaagtttgaccaaatattcgtctgttcccaagcttcgtttgtgctgtgttgccctgtc

FIGURE 18

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FIGURE 18 cont.

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agggcctttgaccactcttgagtagaagactcgagaagaacaaagtagaaggccagagaagaacaaagttact ctggaatgaaaaaaacataatgcatttggtttcttggttccttaggctgttatggaacaaccaaagaacattat tttggtttctgaggtcagaactattttattcccctcaagcacactatgcttatggtttgagggagaatgagaa ataggaaactaggaacaggctgaaatggtctaatcttgaccatctaattctgcagtgtcttattctcattcta aaagagaatggttatattcgctgttctagcataaaaagtaatgataaaaataaaagatcccgtattaccagac aataatcccctagactgttttaatgcttggttgagtatttgcttatgatctcagactttaaaagatggtctcc ccctatggtgaagcttgttaattatgtaggcatcattaatgtctgtttacttatcaaaattttatcattgtta gttgtattactacttgacagtccaatttatttaattgaaaagattggttaacattttatagtcaaagtaattg tttcctgtgtttttcctgtttag**GTTATTGGAGTGATAAAGAATACATACCAAAGGGCACACGTTTTĞ** GACCCCTAATAGGTGAAATCTACACCAATGACACAGTTCCTAAGAACGCCAACAGGAAATATTTTTGGAGGG aagtaagggaaatttcttcagacccattaaatgttaggaaaaaatggagctaaaagagctgggtggctcacct ttctcatcctgtgctgagaaatgctggggctcacccataagtatccagcatccccatggacacagggaattct gaacaaatgtgatgaaaccgatgaaatgtctggcctgtaggtggttagtgatggagatacgggctatatgtga catttgcatttctccgcaaggaagtagtaatgagttaccaagccttagatttcacccctttttgatttcttgc agteteactetgteaccaggetggagtgcaatggcatgateteggeteactgcaaceteeggeteecaggtte aagcaattgtcctgcctcagcctcccgagtagctgggactaaggtgcgcgccaccatgcccagttaatttttg tatttttagtagagaggggttccactatgttggccatgatggtctcgatctctggacctcgtgatccgcca ttataagtaaatgccattaaggaaggatagctggaagatgggttgaggggaatggaggaccacagaactagtc ctatttaaatacatgtgcatggtaaaatgattccatttgacaataggttaattatctcatagcataaggaaaa ctttgctatattagggttagaaaggcccccagaggtgaaccaattagatggaatccttgaataaaacactgga ttagcagtgaacagaaaaagtcagattgctttccttcttcccatagatgtctcagggatatttagtttcctc agaagataaagaatttagtaagcgtttttttgtgcatacttacatgaaatgtacattatttgaattctttaaa tcgttcggacaagaagctattcctaagaaacaatatttttaatccaggaagtttttcatttttagaaatttat

FIGURE 18 cont.

aattattcctccttaaaatattaatcacctgacttacaatggtggaaccatgagtgcatttttgcctttat tgtcaataacgtcttctcagaagtgagccacaaaggtgcatagttcttggagttaaaggtctgaattaagaca atccagcataagtctcattaatgtgtgattattttgagaaaaggcaagaagtacctaagaatctccccctcac atcagtctttcacatgcaaaggatattgtagaacatctcgtttttgctggcaggaatatgaacatctgttgtg aggaaagaaaaagtttcatgcaaattacactgccaaagaagggatgttcaagttgagaaaccagtgacatttc ttgtaactgtactatgaatcagcgcattttaatcttctagataatatatggaagtgcaggaaggtggtaggaa aatgaggatacagtaaattgcagtccgaggaaggctaactggaatcaacatacccgtagctttagaaagcagt ttccgcaccagcgaagagtacaagagcgatggaaccccatgttcctggaagtttgcacatcagagtaaacaaa cttgaaaacccctcttgatagcagaattcacccagccttgttccattttctcttaacaaaacacaccgcaaaa gctctcacaagctgctttgatgaagccacatgtatttcccccttcacaatttacaggaagttactcttaaaag aaagtgattctggtgtttaccgcctgtgttaaagggacagagttcctttttatttctgataacgtttgagcga aatacagaaactatetgtagaetageatagteggtaegtgagtaaggaaaageaataaeetgetgteeggtga gcacaaaattcctgctacgaacagtgccttactgctgcttggagactgcaagtcgcagatcacactaggtatt gactgattgtataaggaaatttcttaaagtctaaagtaaaggtggtacctcctaaaaagaggggaagagaga aactitgtgtggaaggataaggagtgtgtttatagtttcagtaagagtgtacgttttaattittcttcttcct ctgcctctttgccaagtagcctgagtgcatctgttatccagaagtagtattactctaggacaaacttcaaatt cttcattctgcgttgcctttaaggaacaacatactttcttcctgttcttttccaaaaacacacgcctatggc tetgtgtgtgtgttttagccagcctcctcccagataaggggttcccttccctcttgcattgaaaggaaag tgcaagtctggacatgtttatcaagaggaaaagtgacttctcagtaatagactgtcaaattcgggctgctgcc ccaagtattcatatgaacaagtgttactttaggacttggagggttgggggtggaggatgtttgcatagttgaa gccttgggcgggggtgtaggaaacggcgagtacagaggccatagaaaaagctaagactcagtttgacgtcgtc agccggcttggtcttctacccagtgactcaaagcactaaaagtcagcataatcggaactgaagtcagtagcat cgcccatttgccattcactgcagtagcaaaagtagtactctgtggtgggttaatcggtttgaggcagctcctt aaatgaacatttgtgtttcatttttctgttattttcccgaacatgaaaagacgataaaactgaaatggaaaag gtaactgacaaaagtgtgccttacctgtttccgccctgatttctgctgattcaagactattctggctaaactg attggattctttttctaactaggcagtaggggatcagaaatcacacacggtaccggctgtgtttattctgaga MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 29 of 39

ggtgctggggagctttgggtctgacttccttttacatgcctgtcttctctttttggacagATCTATTCCAGAGG GGAGCTTCACCACTTCATTGACGGCTTTAATGAAGAGAAAAGCAACTGGATGCGCTATGTGAATCCAGCACAC TCTCCCCGGGAGCAAAACCTGGCTGCGTGTCAGAACGGGATGAACATCTACTTCTACACCATTAAGCCCATCC CTGCCAACCAGGAACTTCTTGTGTGGGTATTGTCGGGACTTTGCAGAAAGGCTTCACTACCCCTTATCCCGGAGA GCTGACAATGATGAATCTCAgtaagtggattacagaacaaaaaaataaaaaatgccagtaatgtcggttctgc ccctttgaactaataacatgttgtttaattatacggctttgtcatgtgttggatgaagtaggtggcttaagct agggactaggaagaggaaaaacattttttgagtccctattaactattaggaaacttgatcatttaaaagtata tatatatatgaggagctaccttgagttttgaattcaggatgttacaggaagaaatatatgtccaattctaatt tatccaaaagcagttgggagaattacagggattggtccagacatgctgcgtatgcaaggtatagccctcatct gtggtactttggcagggcttagactgcatcaaaatatttatagatgtacatttgagtgtacagttaggatctg atgtggaacattgtaagatcattgctagaaaaactttgtcataatttttcaatattattctaagtgaataacc gtaaagattttacatcttagcttccttccttacagtaaaaaactatctgatctcttgatcagtattatagta gccacctatcactttatcttaacaaattctcaattccttaggtttatgtgcttttacttctttatttgatta aaattgctgtcatgacctctctctgcagagggctgcatcatttttggtcattctcaagtgatctctttgagcaa tttaagaattgccataagattctaacctctgctgtaactatggttgtgtgttcttggttagaccactaaatct tattagcagttttaaaaattattccttttggtttagaagttaagactaaatgctgaagtttttgtaacttttg gttttgatatcatttcaaacttaagaaaacatttgaagaaaaggacaaagaatttccacttacccta ggtttaccagttattgataagtatatccatttgctttaccagaaggctaacttgttttagttctcattttcac ctttgagacatttggaataaatatcaatgttaacataaattggaattttgactttgattttaggaccaatgaa

FIGURE 18 cont.

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FIGURE 18 cont.

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FIGURE 18 cont.

TTGCATAGCCTTCCCATTACTAAGACTATTACCTAGTCATAATTATTTTTTTCAATGATAATCCTTCATAATTT **ATTATACAATTTATCATTCAGAAAGCAATAATTAAAAAAGTTTACAATGACTGGAAAGATTCCTTGTAATTTG** AGTATAAATGTATTTTTGTCTTGTGGCCATTCTTTGTAGATAATTTCTGCACATCTGTATAAGTACCTAAGAT GCCAATGTTGGACAGTTGATGTGTTCATTCCTGGGATCCTATCATTTGAACAGCATTGTACATAACTTGGGGG TATGTGTGCAGGATTACCCAAGAATAACTTAAGTAGAAGAAACAAGAAAGGGAATCTTGTATATTTTTGTTGA TAGTTCATGTTTTTCCCCCAGCCACAATTTTACCGGAAGGGTGACAGGAAGGCTTTACCAACCTGTCTCCC TCCAAAAGAGCAGAATCCTCCCACCGCCCTGCCCTCCCCACCGAGTCCTGTGGCCATTCAGAGCGGCCACATG **ACTTTTGCATCCATTGTATTATCAGAAAATGTGAAGAAGAAAAAAATGCCATGTTTTAAAACCACTGCGAAAA** TTTCCCCAAAGCATAGGTGGCTTTGTGTGTGTGCGATTTGGGGGGCTTGAGTCTGGGTGGTGTTTTGTTGTTGG TTCCTCAGTATTTGTGTTTTTACATTTTATGGTTAATTTAATGGAAGATGAAAGGGCATTGCAAAGTTGTTCA **ACAACAGTTACCTCATTGAGTGTGTCCAGTAGTGCAGGAAATGATGTCTTATCTAATGATTTGCTTCTTAGA** GGAGAAACCGAGTAAATGTGCTCCAGCAAGATAGACTTTGTGTTATTCTATCTTTTATTCTGCTAAGCCCAAA GATTACATGTTGGTGTTCAAAGTGTAGCAAAAAATGATGTATATTTATAAATCTATTTATACCACTATATCAT ATGTATATATATTATAACCACTTAAATTGTGAGCCAAGCCATGTAAAAGATCTACTTTTTCTAAGGGCAAAA AAAAAAAAAAAAAAAAAGAACACTCCTTTCTGAGACTTTGCTTAATACTTGGTGACCTCACAATCACGTCGG TATGATTGGGCACCCTTGCCTACTGTAAGAGACCCTAAAACCTTGGTGCAGTGGTGGGGGACCACAAACCACC **ATGATTATGTGGTCACACCCAAGTCACAGAAATAAAAACTGACTTTACCGCTGCAATTTTTCTGTTTTCCTC** CTTACTAAATACTGATACATTACTCCAATCTATTTTATAATTATATTTGACATTTTGTTCACATCAACTAATG TTCACCTGTAGAAGAGAACAAATTTCGAATAATCCAGGGAAACCCAAGAGCCTTACTGGTCTTCTGTAACTTC CAAGACTGACAGCTTTTTATGTATCAGTGTTTGATAAACACAGTCCTTAACTGAAGGTAAACCAAAGCATCAC GTTGACATTAGACCAAATACTTTTGATTCCCAACTACTCGTTTGTTCTTTTTTCTCCCTTTTGTGCTTTTCCCATA GTTGAGCCCACAATCAACAGTGGTTTTATTTTTTCCTCTACTCAAAGTTAAAACTGACCAAAGTTACTGGCTT TTTACTTTGCTAGAACAACAAACTATCTTATGTTTACATACTGGTTTACAATGTTATTATGTGCAAATTGTC AAAATGTAAATTAAATATAAATGTTCATGCTTTACC

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 32 of 39

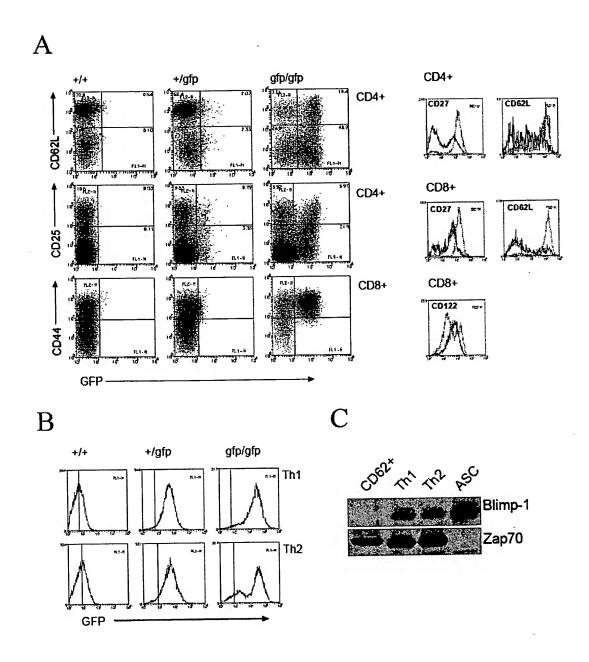


FIGURE 19

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 33 of 39

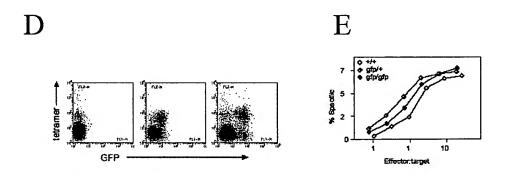
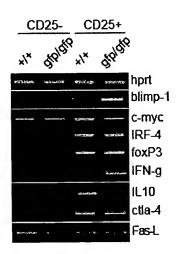


FIGURE 19 cont.

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 34 of 39

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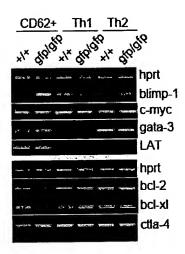
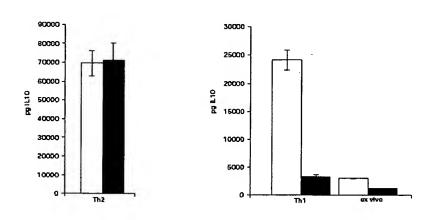


FIGURE 20

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 35 of 39





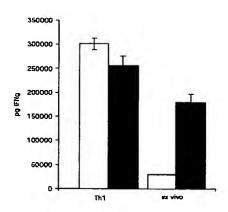


FIGURE 20 cont.

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 36 of 39

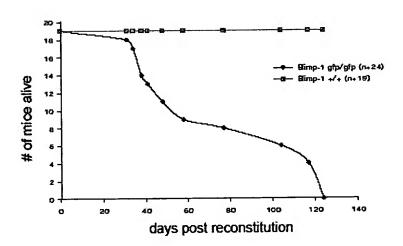


FIGURE 21

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 37 of 39

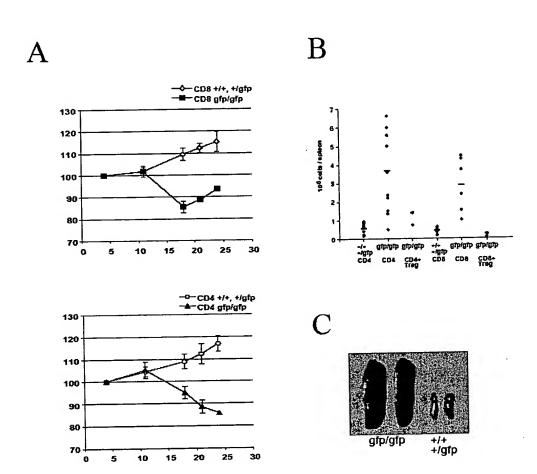


FIGURE 22

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 38 of 39

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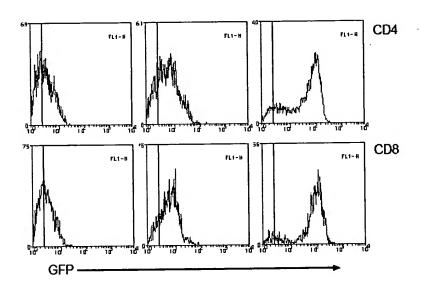
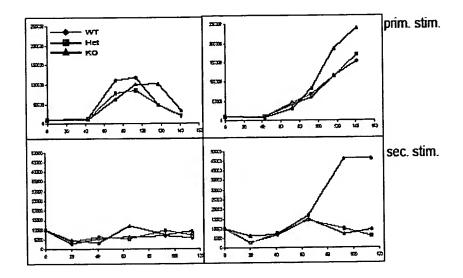


FIGURE 22 cont.

MODIFIED CELLS AND METHODS OF USING SAME Axel Kallies et al. 20155 Sheet 39 of 39

Α



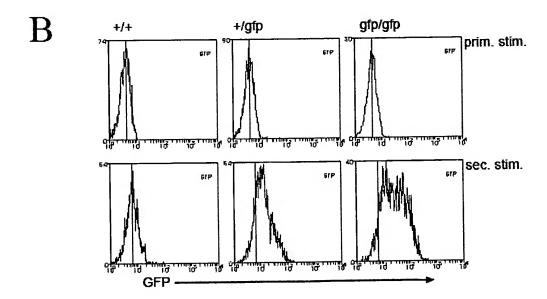


FIGURE 23